EVALUATING THE HONOLULU FIRE DEPARTMENT'S COMMUNICATION CENTER FOR COMPLIANCE WITH CERTAIN ASPECTS OF NFPA 1221

Fire Service Financial Management

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ABSTRACT

The problem was that an analysis had not been conducted to determine if the Honolulu Fire Department's Fire Communication Center was compliant with the National Fire Protection Agency's (NFPA) standard 1221 (the Standard for the Installation, Maintenance, and Use of Public Fire Service Communication Systems) in terms of location, construction, utilities, fire protection, and security. Thus, the purpose of the research project was to evaluate the existing communication center for compliance with NFPA 1221 in the aforementioned areas.

The study conducted was an evaluative research project and was used to determine answers to the following questions: 1. With which sections of NFPA 1221 is the communication center in compliance? 2. In what specific ways does the center measure up to the standard? 3. With which sections of NFPA 1221 is the communication center not in compliance? 4. In what specific ways does the center fail to measure up to the standard? Research was first conducted by examining NFPA 1221 to gain an accurate understanding of the standard, reviewing appropriate literature on the subject, conducting a physical inspection of the facility, personal interviews of experts in this field, compiling data to answer the research questions, and finally developing recommendations.

This provided a basis for the findings discussed in this document. The results indicated that although the Honolulu Fire Department's Fire Communication Center met many of the NFPA's recommendations, several major components remain deficient. Items such as being underground; insufficient vertical and horizontal fire barriers; no independent heating, ventilation, and air conditioning systems; and sub-standard fire protection, detection, alarm, and notification processes existed.

The researcher recommended that either a new stand-alone facility be built or plans for a new administrative building be modified to accommodate a Fire Communication Center that will comply with the guidelines detailed in NFPA 1221.

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INTRODUCTION

Today's fire service must be accountable to and exist under the close scrutiny of its many internal and external stakeholders. Stakeholders such as the communities they serve, the members of its rank and file, and its Board of Governance, are all commonly thought of when discussing stakeholders of any fire service organization. But a more significant influence is derived from the many government agencies that regulate all organizations. The National Fire Protection Agency (NFPA) provides the most guidance to any fire department. Its standards and other publications provide a necessary, and for the most part, helpful guiding hand in all aspects of a fire department's policies, procedures and actions. These standards are periodically updated and are the latest in a long series of editions dating back to 1898.

One standard of particular interest is NFPA 1221, the Standard for the Installation, Maintenance, and Use of Public Fire Service Communication Systems. The problem is that an analysis has not been conducted to determine if the Honolulu Fire Department's Fire Communication Center is compliant with NFPA 1221 in terms of location, construction, utilities, fire protection, and security. Thus, the purpose of this research project was to evaluate the existing communication center's physical facility for compliance with NFPA 1221 in these aforementioned areas.

The research method chosen to determine its compliance was the evaluative methodology that also provided a basis to answers to the following questions:

1. With which sections of NFPA 1221 is the communication center in compliance?
2. In what specific ways does the center measure up to the standard?
3. With which sections of NFPA 1221 is the communication center not in compliance?
4. In what specific ways does the center fail to measure up to the standard?

BACKGROUND AND SIGNIFICANCE

The Honolulu Fire Department provides fire suppression and other emergency services on the island of O‘ahu. Although the department was named after the city of Honolulu when it was founded, today it serves the county of Honolulu, which includes not only the city but the entire island. The island of O‘ahu covers 604 square miles and includes many residential communities, business districts, industrial complexes, agricultural areas, wild lands, and the resort area of Waikiki.

The operational and administrative functions of the Honolulu Fire Department are mandated in the Revised Charter of the City and County of Honolulu and directed by the Fire Chief who oversees a force of 1,036 uniformed fire fighters, 6 of whom are women, and 45 civilian employees. The Department is organized into five operational battalions and four bureaus (Administrative Services Bureau, Training and Research Bureau, Fire Prevention Bureau, and Fire Communication Center). The operational battalions include 43 stations that house 42 engine companies, 14 ladder companies, 1 snorkel company, 2 rescue companies, 2 hazardous materials company, 1 helicopter, 1 fireboat, and 6 tankers (Honolulu Fire Department, 1998).

The department’s Fire Communication Center (FCC) is administratively staffed by a sworn uniformed Battalion Chief and a civilian Senior Clerk Typist who work a Monday through Friday, 40 hour-a-week work schedule. On the operational end, there are four work shifts each comprised of a Captain and four firefighters. Each shift works a 40-hour rotating schedule made up of an 8-hour day and 16-hour night shift. All sworn uniform personnel have at least three years of previous suppression experience and have also completed a rigorous promotional process to attain an assignment to the FCC. As a condition of their promotion, these individuals

(including the Battalion Chief) have contracted with the department to remain in the FCC for a period of 2-years or more. This commitment affords the center stability and continuity of knowledge and experience in dispatching policies and procedures.

In March of 1999, the Honolulu Fire Department completed a major renovation of its Fire Communication Center. The work included, but was not limited to, a complete interior painting, changing out of all floor covering, relocation of some office doors to accommodate new dispatch and call taking workstations, and the replacement of all furniture and equipment. New call taking and processing computers, a new audio recording system, the replacement of radio communication hardware and software, the delivery of a new Computer Aided Dispatch System (CADS), and a records management system were also added. Additional work was done on the existing utilities; including the air conditioning, electrical rewiring, and lighting fixtures.

This renovation work significantly improved the efficiency of the dispatch center but may have failed to consider the recommendations set forth within the established standards of the NFPA. These standards play a major role in defining the criteria of practice for fire departments. Standards are developed by professional organizations to help establish operating norms and certification requirements for personnel and equipment. During the process, people with specialized knowledge work in committees to develop guidelines based on mutual agreement, or consensus. Members of the organization at large then vote to amend and/or adopt the resulting standard. Compliance by fire departments with standards is voluntary, although governmental entities may adopt nationally recognized standards as law (Federal Emergency Management Agency, 1999).

On the surface, it seems that the “refurbished” center is everything one could ask for in a modern dispatch center, but a closer look may or may not uncover deficiencies that existed prior to the renovation work and still remain after its completion.

The Honolulu Fire Department is currently in the process of drawing up plans for a new Administrative Building to house many of its office personnel and functions. This newly planned facility is in close proximity of the existing Fire Communication Center (1/2-mile) and should have the capability to accept the necessary infrastructure from the City’s main communication hub. This hub is where all emergency service agencies (police, fire and ambulance) are linked together by a series of fiber cables and a microwave radio system.

The proposal to include a Fire Communication Center within this new facility has been “pitched” to the Executive Branch of the Honolulu Fire Department but has met with a “cool” response. One major hurdle is the additional cost to add another floor to the already streamlined facility. Another deterrent is the notion that a significant amount of money was recently allocated and expended to complete this recent renovation and it would not be fiscally prudent to consider another upgrade so soon. Questions on whether or not the fiber optic and microwave link between the City’s existing communications network and the new Administration Building also remain.

If there ever was an ideal opportunity to get a communication center that is well planned, but more important, compliant with all government recommendations especially NFPA, it is now. Once the plans for this new Administrative Building move further along, the chances of relocating the dispatch center diminishes greatly. A stand-alone dispatch facility is an option but may be difficult if not impossible to sell in these lean economic times.

The National Fire Academy Executive Fire Officer Program Course, *Fire Service Financial Management,* provides topics relative to issues affecting the Honolulu Fire Department in its requirement to conduct this analysis. Chief Officers face difficult problems in deciding how public resources are to be allocated. In our finite world of limited resources, it is usually possible to promote one worthy objective at the expense of another. If funds are devoted to meeting un-funded mandates requiring specific alterations to fire stations and those funds are diverted from other construction features, what will the impact be? Fire Chiefs often receive insufficient information. Often the information that is provided is highly subjective and judgmental. In Module 6 of this course, guidelines are provided for improving the available information and for enhancing Chief Officers' understanding of the issues underlying today's proposals (National Fire Academy, 1997).

The information derived from this analysis will play a significant role in deciding whether or not consideration will take place to include a dispatch center in the current plans for the Administrative Building or to explore the possibility of a stand-alone facility. This research will afford the decision-makers a comprehensive picture of the situation of the dispatch center relating to the NFPA standard.

LITERATURE REVIEW

The purpose of this review is to provide information from which to develop a solution to the research problem and to summarize critical findings of others that have published documents related to the research problem. There are four content areas specifically relating to dispatch centers: location, construction, utilities, and fire protection.

Location

Edwin J. Spahn (1999) indicates that the access to the dispatch site must be convenient for staff personnel during times of government stress. Public safety system stress, or peak demand, occurs during storms, floods, hurricanes, tornadoes, and similar natural conditions. The access routes and roads serving these centers must be uncluttered and as free from probable debris as practical. The downtown area of many cities is not always in the best of shape during a crisis. Cars, trucks, and buses can, and do, clog the streets. During these times, the coming and going of municipal officials at the operations center may not be possible. Further, the timely relief of communications center staff may also be difficult because of the clutter or siege conditions.

Often there is a desire to have the communications center at city hall, or in a public safety building, usually because this arrangement allows ranking operative governmental personnel instantaneous access to a dispatch room. But Spahn (1999) states that it is not necessarily true that the most convenient location for the communications center is immediately adjacent to the municipal administrative offices, in the center of a city's business district. He states that the center should be free from the threat of any predictable hazards. For example: do not locate a dispatch center in a known flood plain or on the top floor of a four-story wooden construction building, in other words obvious risks.

According to Atkinson (1993), the ideal situation for a new agency is a new companion dispatch facility to go with it. In many cases, this is necessary because of the increase in space required to consolidate the dispatching activities. He also states that remodeling an existing dispatch facility may look like the most economical solution, however there are several disadvantages. It will be difficult to continue to provide service because of the remodeling

taking place. It also gives the perception that the entity whose center is being remodeled will control the agency. This may or may not occur, but the perception is there to the other agency members, especially if that entity is the largest entity in the agency.

Atkinson (1993) notes that locating a new facility is always a problem since everyone involved with the project will have his or her own ideas. He goes further to identify some areas that should be avoided; such as low-lying areas in a flood plain, near active hospitals, in a fire station, areas with poor utilities, near high-tension power lines, areas shielded by adjacent terrain, and on heavy traveled secondary streets.

Construction

Ergonomics is a scientific discipline concerned with the interaction between humans and technology. It is also known as the study of human engineering. This is not at all related to creating androids, but rather creating a total environment that is suited in every way to enhancing our effectiveness as functioning human beings. People need to be in a safe, healthy, nurturing environment. They need bright, warm surroundings that make them feel good about themselves and their work place.

In the design of a modern 9-1-1 facility, there are many facets of the operation that must be considered. Area (square footage), lighting, temperature, humidity control, air filtering and conditioning, console design, windows and window coverings, chair design, access to the center, noise levels, headsets, worker safety—the list is long and the considerations are complex (Parry, 1991)

Workplaces tend to refer to the total environment surrounding where the job/task is performed. A workstation is more related to a fixed place, fixture, or piece of equipment, and therefore more typical of manufacturing industry. The prevention or elimination of ergonomic

injuries requires an evaluation of the total work environment. Workplace designs should reduce extreme and awkward body postures and movements. The locations of parts, tools, and tasks are best addressed during the design state (Federal Emergency Management Agency, 1996).

Anthropometrical studies deal with the relationship of the physical features of the body to its environment. Weight, size, range of movement, and the linear dimensions of the body are all taken into account. Recommended dimensions for the workplace or suggested ranges for weight and force are derived through anthropometrics analysis.

Once the anthropometrical data is generated, it must be used correctly. The department must consider both the specific personnel and data's source. For example, placement of ladders on apparatus for effective work heights for removal and storage based on predominantly male work force will probably not account for the shorter, less-physically fit persons (Federal Emergency Management Agency, 1996).

Designing a workplace for the average male would not adapt to many individuals. The ergonomist's role is to design the workplace for approximately 96 percent of the fire fighter population. Examples of this approach would be providing an adjustable-height workstation of having adjustable platforms available for shorter employees. (Parry, 1991)

At Chicago's Emergency Communications Center each workstation has its own environmental controls for heat, cooling, and lighting that is independent of the main room. Each dispatcher or call taker can make their own adjustments without affecting their co-workers. More important, the keyboard sits on a platform that can be raised or lowered to conform to the person's own needs and comfort (McGregor, 1995).

The centerpiece in a dispatch room is some form of a dispatch console. The console is the interface between the human operator and the electronic equipment. Placement of controls is determined by good and proper human engineering principles (Burton, 1997).

Under the 1991 issue of the Uniform Building Code, with specialized areas for different states, a public safety communications center may be considered a Category 1 Facility, or an Essential Service Facility. It could require the building to be constructed at 1.5 times normal commercial construction requirements. This will add additional cost to the facility. To insure continuous operation of the center, certain mechanical equipment must be redundant. Consideration must be given to the facility requirements of Title 1 of the Americans with Disabilities Act providing for disabled access (Atkinson, 1993)

Atkinson (1993) is of the opinion that space should be allocated for three vending machines: soft drinks, coffee/tea/soup, and snack foods. These are what dispatchers and other staff survive on. The coffee machine will need a water connection. If the center has a quiet room for the dispatchers and it should, then a television should be in the lunchroom area. If it does not, then a decision on the TV must be made.

Quiet and orderly flow of information is the central theme in a dispatch room. At no time should any nondispatch personnel be in the room unless there are specific reasons for the visit. The dispatch room should never become the local hangout where all can “find out what’s happening!” Even if the radio traffic is light, the possibility of disturbing personnel or even destroying records is too great (Spahn, 1999).

Utilities

Atkinson (1993) states that redundant heating and air conditioning is required to insure continued operation during single unit failure. Most facilities are sealed buildings relying on

heating and air conditioning to provide the proper work environment. If you lose your air conditioning during the middle of summer you would soon be working in a “sweat box” which would cause damage to the personnel and the equipment. Loss of heat produces the same problem. You must have redundant heating and conditioning units. The chiller units are major vibration generators, and must not be mounted in, on, or near the building.

Spahn (1999) indicated that the air inlets and exhausts for the heating, ventilating, and air conditioning (HVAC) systems should be positioned where they are not vulnerable to capture by hostile forces. This is very important in times of civil disturbance. Rural or suburban locations, even for dispatch centers serving cities, can be a positive feature. The ability to defend the site from intruders is much easier in the uncluttered open area than in the central city where urban disturbances are more likely to occur. The varying sizes and heights of surrounding buildings in downtown areas make the dispatch center more vulnerable from a greater variety of angles. Care must be exercised not to allow the communications center site to easily come under siege.

Creature comforts are important. These features appear in the form of appropriate lighting, ventilation, humidity control, and temperature control. Keeping operators alert at all times can be difficult. The environment must be fresh, smoke free, frequently changed, neither too warm nor too cool (Spahn, 1999).

Detailed work makes great demands on the eyes. Light meters or photometers can be used to measure illumination levels. If the illumination is inadequate and not glare-free, the worker must lean forward or to one side to see clearly (Federal Emergency Management Agency, 1996).

Give proper attention to lighting direction as well as intensity. Overhead lighting angles, which cause reflections from cathode-ray tubes (CRTs), are especially fatiguing for operators.

Lighting for right-handed personnel should come from front left of the user, the opposite side for left-handed operators. A light source ten to eighteen inches above the worktable of the user is adequate. High-intensity lighting is not necessarily desirable. Most often it is not. Ambient lighting must not overcome the light output of the many console indicator lights, or CRTs with which the dispatchers work (Spahn, 1999).

The dispatching area requires different lighting than the remainder of the building. All lights must reflect their light emission to the ceiling. Direct downward lighting is a major no-no under any circumstances. Upward lighting fixtures are round and hang down from the ceiling. They consist of two tubes within a half-round housing with a standard length of 8-feet. Other sizes are available, but you should not exceed 8-feet in one fixture. These are installed in rows across the dispatch center. They will eliminate the glare on video display terminals used in your CAD system. Each fixture should have its own wall switch. This permits the shift supervisor to adjust the overall light level. The days of dispatchers working in the dark or under overhead track lights have long passed (Atkinson, 1993).

Emergency lights are required during the power loss period. This usually is a pack of two lights and a large battery, mounted high on the walls. These are time consuming to maintain and are an eyesore. Instead, discuss with the architect and electrical engineer the possibility of using built-in emergency packs in certain ceiling lights (Atkinson, 1993).

Atkinson (1993) says that most radio equipment rooms use 7.5-foot racks in which radio equipment is mounted. A grid of cable racks running overhead and fastened securely to the walls interconnects these racks. Cable interconnection is run overhead. Computer flooring is not necessary in these areas. The racks are securely mounted to the floor and to the cable racks giving exceptionally strong support. A series of 4-inch conduits should interconnect the dispatch

area to this room. In addition, a single 4-foot conduit should connect the radio equipment room to the telephone room and another to the computer room. In the radio equipment room, the conduit is usually turned up against the wall. The cable tray is extended down from the overhead to meet the conduit. The radio equipment room should have painted 4' x 8' finished ¾-inch plywood on the walls. Extra backing (2-inch x 10-inch) should be installed around the walls at the 7-foot level to provide a means to secure the racks.

Fire Protection

What should be done in an emergency or when everything goes wrong? With a catastrophe, the dispatcher could be injured. In some disasters, the actions of the dispatcher during and after may mean the difference between life and death for many people, including the dispatcher. The dispatcher may have to make a choice about when to leave a building.

Once a dispatcher has made assurances for his/her safety, there are certain things that must be done. There is a basic tenet that says, "Always call for help before trying to help." If a fire should erupt in a dispatch center, the wise dispatcher would call for help (the fire department) first before trying to fight the fire (Burton, 1998).

Building codes should require an overhead fire sprinkler system. If the State or local code does not, install one anyway. You cannot afford for a fire to get started within the center. The system should be a "Dry System." It is inter-tied to smoke or other type detectors and requires a signal from the detector and a "popped" head before it will charge the line with water. This protects against someone accidentally knocking a sprinkler head off (Atkinson, 1993).

Security

A fire department can build the finest communications system available yet, have it fail if its security and safety are not adequate. Security and safety for an emergency communications

system mean more than building a fortress. It means protecting the system from all threatening elements, including natural and man-made hazards, and should be a basic consideration in planning a communication center (Federal Emergency Management Agency, n.d.).

The degree of security is directly proportional to the amount of money you desire to expend. A closed circuit television system should be installed to provide monitoring of the outside area and the gated entrances. This should terminate in the dispatch center. The main visitor entry requires a camera to identify the party requesting entry with a monitor in the main office for day use and the dispatch center for after hours.

An intercom is required to the gate and front door. If the facility has a secured service yard, intercom and camera coverage is required. All outside doors and gates should have remote opening from the dispatch center. They also must have an indicator showing in the dispatch center when any door is open (Atkinson, 1993).

Since the start of the "Cold War" dispatch centers have been built like a fortress with 8-foot concrete walls and no windows. This was to meet Federal guidelines and to obtain Federal funding. In recent years the major concern of dispatch centers is natural disasters and general law enforcement security. Windows are starting to appear in dispatch centers.

Their placement must be done with care. A first floor dispatch center with windows makes it very difficult to provide any degree of security and should be avoided. Centers on upper floors can accommodate windows, but examine the paths from the personnel at workstations to any surrounding windows. The other area of concern is the placement of windows with respect to CAD and console terminals. Direct sunlight on a console and CAD terminal will make it impossible to use the workstation. Dispatchers should not be positioned so they are facing the windows. Eye problems will appear almost immediately (Atkinson, 1993).

Summary

There are many dispatch centers that have found success in the design and construction of their facility. One such success story is the San Diego Police Department's Public Safety Answering Point. The management there has gone through great lengths to help relieve stress by improving the surroundings of the center while maintaining compliance with the applicable standards and codes. Here, a lot of green plants, soft lighting, and wood furnishing were used. This coupled with huge floor-to-ceiling windows that look out over the city achieved a real calming affect (Davis, 1998).

Finding the right balance between complying with standards of construction and design for communications centers and the importance of addressing the individual needs of the personnel who occupy the center is a definite challenge to designers and planners.

PROCEDURES

The process and procedures set forth to establish an evaluation of the Honolulu Fire Department's communication center for compliance with NFPA 1221 were four fold. First, the National Fire Protection Association Standard 1221 was examined very closely to gain an accurate understanding of the standard as it pertains to the research. Second, appropriate literature was reviewed to support the author's premise and to check and balance the interpretation of the standard with that of noted experts in the field of emergency communications. Third, a physical inspection of the existing facility, a review of the policies and procedures of the Fire Communication Center, and interviews key players in the subject area within the City and County of Honolulu were conducted. Fourth, the data compiled was evaluated to attempt to answer the research questions and develop to recommendations.

NFPA 1221

The most current edition of this standard was obtained from the library of the Honolulu Fire Department's Fire Prevention Bureau. This 1999 Edition was the Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems. The purpose of this standard was to specify operations, facilities, and communications systems facilities that receive alarms from the public and to provide requirements for the re-transmission of such alarms to the appropriate emergency response agencies. It was the intent of this standard to establish the required levels of performance and quality of a fire communication center (National Fire Protection Association, 1999).

Selected sections of Chapter 2 were reviewed in order to obtain a grasp of the information being conveyed regarding these standards that allowed the author to evaluate the existing communication center facilities and infrastructure. This knowledge also provided the necessary level of expertise to interact with industry experts and gain further insight into the compliance issues of the center.

Review of Existing Literature

Here the critical findings of others who have published documents related to the research problem and clearly describes how such information influenced the author's research effort. The information was gathered from the libraries of the Honolulu Fire Department, the City and County of Honolulu's Municipal Reference and Records Center, the National Fire Academy's Learning Resource Center, and that of the University of Hawaii at Manoa. Additional searches were conducted via the Internet and these searches resulted in the purchase of literature relating to the requirements of a dispatch center.

Physical Inspection of the Communication Center

An actual inspection of the center was conducted to compare what actually exists with what is described in the standards of NFPA 1221. Actual aspects relating to location, construction, utilities, fire protection, and security were scrutinized. Where uncertainty existed as to compliance to the standard, industry experts were consulted. One such expert was James Wataru of the City and County of Honolulu's Building Code Branch of the Department of Planning and Permitting. Mr. Wataru, who has 27 years of experience in building code interpretation and enforcement, was interviewed on February 20, 2001. His assistance was needed on issues specifically pertaining to the construction and utilities contained in the Honolulu Municipal Building where the communication center is located.

Another expert that provided invaluable assistance was Fire Captain Stephen Kishida of the Honolulu Fire Department's Fire Prevention Bureau. Captain Kishida has a total of 20 years in the fire service of which 11 years were spent in the plans review and codes interpretation. Captain Kishida provided insight to the fire protection appliances and systems that services the communication center and was also interviewed on February 20, 2001.

Data Compilation

The data collected through the literature review and the above-described procedures were evaluated in order to answer the research questions, arrive at the final results, and develop recommendation on the subject of compliance to certain aspects of NFPA 1221 to the physical plant of the Fire Communication Center.

Limitations

The six-month time limitation for submission of this research paper to the National Fire Academy's Executive Fire Officer Program resulted in a partial comparison between the existing

communication center and the standards of NFPA 1221. This standard contains ten chapters but only specific sections of Chapter 2 were evaluated to narrow the research to a more manageable level. The specific areas of research namely location, construction, utilities, fire protection and security provide a representative view of the overall compliance issue and should be adequate for decision-making.

Future research on this subject should explore the actual dollar cost of total compliance of the communication center to the standards contained within NFPA 1221. The narrowness of this research also provides the opportunity for others to expand this subject matter as it specifically relates to the Honolulu Fire Department's Fire Communication Center.

RESULTS

1. With which sections of NFPA 1221 is the communication center in compliance?

§2-2.1 *If the building that houses a communication center is located within 150 ft (46 m) of another structure, special attention shall be given to guarding against damage from exposure by such a building by protecting openings and by constructing the roof to resist damage that might be caused by falling walls.*

§2-2.3 *Each jurisdiction shall maintain an alternate communications facility that is capable, when staffed, of performing the emergency functions provided at the communication center. The facility shall be separated geographically from the primary communication center at a distance that ensures the viability of the alternate facility concept.*

§2-2.4 *Each jurisdiction shall develop a formal plan to maintain and operate the alternative communications facility. The plan shall include the ability to reroute incoming alarm*

traffic and to process, dispatch, and control emergency alarms. The plan shall be included in the comprehensive emergency management plan (CEMP).

§2-3.1 *Buildings that house communication centers shall be of Type I, Type II, or Type III construction as defined by NFPA 220, Standard on Types of Building Construction. The building shall have a Class A roof as defined by NFPA 256, Standard Method of Fire Testing of Roof Coverings.*

§2-3.3 *Communication center interior finish material, as defined by NFPA 101®,Life Safety Code®, shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less, when tested in accordance with NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.*

§2-3.5 *The communication centers shall be protected against seismic damage in accordance with applicable building codes that are required by the authority having jurisdiction.*

§2-5.1 *The communication center shall be provided with fire extinguishers that meet the requirements of NFPA 10, Standard for Portable Fire Extinguishers..*

§2-5.5 *In the event of a fire in the communication center, or in the building that houses the communication center, the communication center shall be capable of continuous operation long enough to enable transfer of operations to an alternate communication center that is capable of continuous operation.*

§2-6.1 *The communication center and other buildings that house essential operating equipment shall be protected against damage due to vandalism, terrorism, and civil disturbances.*

§2-6.2 *Entry shall be restricted to authorized persons. Entryways that lead directly from the exterior shall be protected by a security vestibule.*

§2-6.3 *Door openings shall be protected by not less than a 1-hour, listed, self-closing fire door assembly.*

§2-6.4 *Where a communication center has windows, the following requirements shall apply.*

(1) Windows shall be a minimum of 4 ft above floor level.

(2) Windows shall be rated for bullet resistance to medium-power small arms, high-power small arms, high-power small arms, super-power small arms, and high-power rifles as specified in ANSI 752, Standard for Safety Bullet-Resisting Equipment.

Exception: Windows that are not bullet resistant shall be permitted, provided that they are located facing an area that cannot be accessed or viewed by the general public.

(3) *Windows shall be arranged so that they cannot be opened.*

2. In what specific ways does the center measure up to the standard?

§2-2.1 *If the building that houses a communication center is located within 150 ft (46 m) of another structure, special attention shall be given to guarding against damage from exposure by such a building by protecting openings and by constructing the roof to resist damage that might be caused by falling walls.*

There are no buildings within 150 feet of the Honolulu Municipal Building (HMB).

§2-2.3 *Each jurisdiction shall maintain an alternate communications facility that is capable, when staffed, of performing the emergency functions provided at the communication center. The facility shall be separated geographically from the primary communication center at a distance that ensures the viability of the alternate facility concept.*

The Honolulu Fire Department has an alternate communication center that is fully equipped to perform the emergency functions now provided at the FCC. This alternate site is located at the Central Fire Station that is approximately 2 miles away.

§2-2.4 *Each jurisdiction shall develop a formal plan to maintain and operate the alternative communications facility. The plan shall include the ability to reroute incoming alarm traffic and to process, dispatch, and control emergency alarms. The plan shall be included in the comprehensive emergency management plan (CEMP).*

The Honolulu Fire Department's Fire Communication Center has developed and implemented a Standard Operating Procedures Manual that describes the maintenance and operation of the alternative communication facility. These procedures include provisions for rerouting incoming alarm traffic and to process, dispatch, and control emergency alarms.

§2-3.1 *Buildings that house communication centers shall be of Type I, Type II, or Type III construction as defined by NFPA 220, Standard on Types of Building Construction. The building shall have a Class A roof as defined by NFPA 256, Standard Method of Fire Testing of Roof Coverings.*

The communication center is considered to be of Type I construction. Type I construction is that type in which the structural members, including walls, columns, beams, floors, and roofs, are of approved noncombustible or limited-combustible materials and have fire resistance ratings not less than those set forth. Fire resistance requirements for those supporting more than one floor, columns, or bearing walls, and/or supporting a roof only are as follows:

- For exterior bearing walls 4 is required for Type I 443 and 3 is required 3 for Type I 332
- For interior bearing walls, columns, and beams, girders, trusses, and arches 4 or 3 is required for Type I 443 and 3 or 2 is required for Type I 332

- For floor construction a 3 is required for Type I 443 and 2 for Type I 332
- For roof construction a 2 is required for Type I 443 and 1 & ½ for Type I 332

The communication center has a Class A roof. As defined by NFPA 256, Class A tests shall be applicable to roof coverings that are effective against severe test exposure, afford a high degree of fire protection to the roof deck, do not slip from position, and do not present a flying brand hazard (S. Kishida, personal communication, February 20, 2001).

§2-3.3 *Communication center interior finish material, as defined by NFPA 101®,Life Safety Code®, shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less, when tested in accordance with NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.*

The communication center uses paint as the interior finished material. The requirement for a Type I construction is based on the thickness of the material. Therefore paint used in the building is much thinner so it should not be a problem. (J. Wataru, personal communication, February 20, 2001).

§2-3.5 *The communication centers shall be protected against seismic damage in accordance with applicable building codes that are required by the authority having jurisdiction.*

When the Honolulu Municipal Building was built in 1974, requirements for protection against seismic damage in accordance with the applicable building codes were all met (J. Wataru, personal communication, February 20, 2001).

§2-5.1 *The communication center shall be provided with fire extinguishers that meet the requirements of NFPA 10, Standard for Portable Fire Extinguishers.*

The FCC meets the requirements set forth in NFPA 10 by having two wall mounted 2A10BC portable fire extinguishers.

§2-5.5 *In the event of a fire in the communication center, or in the building that houses the communication center, the communication center shall be capable of continuous operation long enough to enable transfer of operations to an alternate communication center that is capable of continuous operation.*

The center is equipped with uninterrupted power supplies (UPA) and a back up generator to provide continuous operation in the event a fire would render the power supply into the center unusable. There is an alternate communication center within a ¼ mile and evacuation plans have been established to provide uninterrupted operations.

§2-6.1 *The communication center and other buildings that house essential operating equipment shall be protected against damage due to vandalism, terrorism, and civil disturbances.*

Located in a secured basement, the FCC is protected against damage due to vandalism and civil disturbances.

§2-6.2 *Entry shall be restricted to authorized persons. Entryways that lead directly from the exterior shall be protected by a security vestibule.*

The basement of the HMB is restricted to unauthorized individuals and monitored by a guard that is located in the building's rotunda. The FCC is further secured by the use of observation cameras at all points of entrance, a two-way intercom system, and an electronic buzzer and door opening system.

§2-6.3 D*oor openings shall be protected by not less than a 1-hour, listed, self-closing fire door assembly.*

The entrance doors into the FCC are self-closing and rated at 3 hour.

§2-6.4 *Where a communication center has windows, the following requirements shall apply.*

(4) Windows shall be a minimum of 4 ft above floor level.

(5) Windows shall be rated for bullet resistance to medium-power small arms, high-power small arms, high-power small arms, super-power small arms, and high-power rifles as specified in ANSI 752, Standard for Safety Bullet-Resisting Equipment.

Exception: Windows that are not bullet resistant shall be permitted, provided that they are located facing an area that cannot be accessed or viewed by the general public.

(6) Windows shall be arranged so that they cannot be opened.

The communication center does not have any windows.

3. With which sections of NFPA 1221 is the communication center not in compliance?

§2-2.2 *A communication center shall not be located below grade. The lowest floor elevation shall be above the 100-year flood plain.*

Exception: communication centers shall be permitted to be located below grade where specifically designed for such a location.

§2-3.2 *Where the building is also occupied for purposes other than emergency communication, the communication center shall be separated from the other portions of the building by vertical separations that have a fire resistance rating of at least 2 hours in accordance with NFPA 221, Standard for Fire Walls and Fire Barrier Walls, and by horizontal fire barriers that have a fire resistance rating of at least 2 hours as defined by NFPA 251, Standard Methods of Tests of Fire Endurance of Building Construction and Materials. Openings in fire barriers with a fire resistance rating shall be protected by listed, self-closing fire doors or other assemblies that have a fire resistance of not less than a 1 ½-hous to 2 hours.*

Openings in fire barriers with a fire resistance rating of greater than 2 hours shall be protected by listed, self-closing fire doors or other assemblies that have a fire resistance rating of not less that 3 hours.

§2-3.4 *The communication center shall be equipped with both a toilet and lunch area that is directly accessible to the operations room within the secured area as required by 2-6.1.*

§2-4.1 *Heating, ventilation, and air conditioning (HVAC) systems shall be independent systems that serve only the communication center. Intakes for fresh air shall be arranged to minimize smoke intake from a fire inside or outside the building.*

§2-4.1.1 *The air supply shall be in accordance with NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems, and NFPA 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.*

§2-4.1.2 *Alternate HVAC shall be provided for the communication center for use during routine maintenance of the primary system or in the event of a primary system failure. Backup HVAC systems shall provide sufficient conditioning of air to allow efficient functioning of telecommunicators and equipment in the communication center.*

§2-4.2 *No main utility services shall pass through those portions of the communication center where equipment essential to receiving and retransmitting dispatching is installed*

§2-5.2 *The communication center, and spaces adjoining the communication center, shall be provided with an automatic fire detection, alarm, and notification system in accordance with NFPA 72, National Fire Alarm Code. Operation of notification appliances shall not interfere with communications operations. The alarm system shall be monitored in the operations room.*

§2-5.3 *The building that houses the communication center and the communication center itself shall be protected throughout with an approved, automatic fire sprinkler system that*

complies with NFPA 13, Standard for the Installation of Sprinkler Systems. The sprinkler system shall be supervised in accordance with NFPA 72, National Fire Alarm Code, and monitored in the operations room.

§2-15.4 *Where applicable, electronic computer/data processing equipment shall be protected in accordance with NFPA 75, Standard for the Protection of Electronic computer/Data Processing Equipment.*

4. In what specific ways does the center fail to measure up to the standard?

§2-2.2 *A communication center shall not be located below grade. The lowest floor elevation shall be above the 100-year flood plain.*

Exception: Communication centers shall be permitted to be located below grade where specifically designed for such a location.

According to James Wataru (personal communication, February 20, 2001) Zones A or V is considered flood zone areas. The communication center is in zone X, therefore not in the restricted flood zone area. The FCC is located in the basement of the Honolulu Municipal Building (HMB). The HMB is a 16 story high-rise office building with a basement that houses the City's Information Technology Data Bases, the Oahu Civil Defense Office, the offices of the building's janitorial service, and the Honolulu Fire Department's Fire Communication Center. The HMB was built in 1974 and the FCC moved into this location on 1991. The basement was not specifically designed for housing the fire department's dispatch center.

The HMB is located at 650 South King Street, in City and County of Honolulu. The 100-year flood plain prediction does not include the parcel upon which this building is located.

§2-3.2 *Where the building is also occupied for purposes other than emergency communication, the communication center shall be separated from the other portions of the*

building by vertical separations that have a fire resistance rating of at least 2 hours in accordance with NFPA 221, Standard for Fire Walls and Fire Barrier Walls, and by horizontal fire barriers that have a fire resistance rating of at least 2 hours as defined by NFPA 251, Standard Methods of Tests of Fire Endurance of Building Construction and Materials. Openings in fire barriers with a fire resistance rating shall be protected by listed, self-closing fire doors or other assemblies that have a fire resistance of not less than a 1 ½-hous to 2 hours.

Openings in fire barriers with a fire resistance rating of greater than 2 hours shall be protected by listed, self-closing fire doors or other assemblies that have a fire resistance rating of not less that 3 hours.

The HMB is occupied by numerous City agencies, one being the Honolulu Fire Department's FCC. There are no vertical separations between the adjacent agencies on the Basement floor specifically between the Oahu Civil Defense, the City's Information Technology Data Processing Center and the City's janitorial staff office. There is horizontal separation meeting the 2-hour fire resistive rating between all basement occupancies and those on the first floor.

§2-3.4 *The communication center shall be equipped with both a toilet and lunch area that is directly accessible to the operations room within the secured area as required by 2-6.1.*

The communication center does not have a lunch area. The toilet facilities are in an adjacent non-secured area that is accessible by having to exit the center.

§2-4.1 *Heating, ventilation, and air conditioning (HVAC) systems shall be independent systems that serve only the communication center. Intakes for fresh air shall be arranged to minimize smoke intake from a fire inside or outside the building.*

The air conditioning system serving the FCC is a shared and common system that services the entire building.

§2-4.1.1 *The air supply shall be in accordance with NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems, and NFPA 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.*

The air supply of the HMB is not in accordance with NFPA 90A and NFPA 90B since these standards were not in existence at the time the building was designed and constructed (J. Wataru, personal communication, February 20, 2001).

§2-4.1.2 *Alternate HVAC shall be provided for the communication center for use during routine maintenance of the primary system or in the event of a primary system failure. Backup HVAC systems shall provide sufficient conditioning of air to allow efficient functioning of telecommunicators and equipment in the communication center.*

There is no alternate HVAC for the communication center.

§2-4.2 *No main utility services shall pass through those portions of the communication center where equipment essential to receiving and retransmitting dispatching is installed*

Telephone, communication, air conditioning ductwork, and electrical conduits pass directly over the entire FCC within the drop ceiling.

§2-5.2 *The communication center, and spaces adjoining the communication center, shall be provided with an automatic fire detection, alarm, and notification system in accordance with NFPA 72, National Fire Alarm Code. Operation of notification appliances shall not interfere with communications operations. The alarm system shall be monitored in the operations room.*

The alarm system is not monitored in the operations room but in an adjacent room. The enunciator panel is located in a room that is not normally occupied and is at a distance from the communication center which will preclude its monitoring by the on-duty personnel.

§2-5.3 *The building that houses the communication center and the communication center itself shall be protected throughout with an approved, automatic fire sprinkler system that complies with NFPA 13, Standard for the Installation of Sprinkler Systems. The sprinkler system shall be supervised in accordance with NFPA 72, National Fire Alarm Code, and monitored in the operations room.*

The existing sprinkler system is based upon an old Halon protection system that has since been banned for any facility intended for human habitation (S. Kishida, personal communication, February 20, 2001).

§2-15.4 *Where applicable, electronic computer/data processing equipment shall be protected in accordance with NFPA 75, Standard for the Protection of Electronic computer/Data Processing Equipment.*

The existing sprinkler system is based upon an old outdated Halon protection system that is not in accordance with NFPA 75 (S. Kishida, personal communication, February 20, 2001).

DISCUSSION

The Honolulu Fire Department's Communication Center currently meets many of the NFPA's recommendations; however, several major components remain deficient.

The Fire Service does not have true regulations binding them to the requirements for the design and construction of communication centers. However, NFPA 1221, developed by our peers, is considered guidance for the safe and comfortable housing of equipment and personnel.

Many communications centers are located in or around a jurisdiction's civic center. This allows convenient access by high-ranking municipal personnel. Spahn (1999) states that this is undesirable and distractive to center staff. He goes on to say that traffic congestion commonly associated with downtown areas makes it difficult for relief personnel to report for duty. This can be further aggravated during times of crisis. Spahn (1999) stresses that the location within the building that the center is located can also increase its vulnerability and risk.

While I agree that locating the dispatch center outside the downtown area may be better, this is not always practical due to infrastructure resource limitations. The City of Honolulu currently utilizes an isolated fiber optic cabling and microwave radio system that is limited to the downtown area. Thus, all emergency services have located their dispatch centers in close proximity to the downtown area to capitalize on this technology.

The current location of the dispatch center within the City has minimal implications for either dispatch personnel or management staff. The city has experienced many crisis situations and ingress and egress to the center has always been adequate. As stated earlier, the dispatch center is currently located in the basement, which may pose significant risks to continued overall operation of the department. While the building is not technically located in a flood plan, internal plumbing problems may potentially cause flooding within the center. Due to the highly sensitive nature of the equipment, even the smallest amount of moisture can literally take down the system. Now, imagine the resulting damage of a broken water main. The design and construction of a new center would incorporate necessary safeguards, and virtually eliminate the potential for such a threat.

According to Atkinson (1993), it is more desirable to build a new center than refurbish an existing. I agree with this concept. Attempting to renovate an existing facility severely limits

the design options due to inadequate or non-accommodating spatial elements. This is especially true when trying to install the necessary utilities or additional break and bathroom facilities. Squeezing more out of an existing and fixed building footprint is extremely challenging. Recent renovations to the existing communications center have fallen short of the guidelines found in NFPA 1221, especially the inability to relocate the center from its current basement location.

Atkinson (1993) emphasizes the need to consider a dispatch center as an Essential Service Facility, requiring the building to be constructed at 1.5 times the normal commercial construction requirements. The HMB meets this requirement, but additional recommendations by NFPA suggest the installation of horizontal separation between adjacent agencies. I fully agree that the installation of 2-hour fire protective barriers would reduce the risk of fire spread into the center and provide a virtual building within a building.

Atkinson (1993) goes on to say that the environment needs to promote a healthy, safe, and nurturing atmosphere. Components such as a quiet room, easily accessible restroom facilities, kitchen, and a lunchroom should be within the center itself. The current design fails to provide any of the items listed above. I agree with this recommendation and I believe that it will promote a more productive work force resulting in enhanced emergency operations. Additionally, having these facilities in close proximity to the operational floor allows for recall of dispatch personnel from the break areas should the need arise.

According to FEMA (Federal Emergency Management Agency, n.d.), the safety and security of communications systems and personnel must be considered. Means of protecting against natural and man-made hazards must be included in the planning process. The HMB currently has redundant security. The posting of a guard restricts access to the entire basement

area. Should the guard fail, closed circuit television, intercom system, and self-closing locking doors provide an additional level of protection.

With the increased instances of civil unrest and the potential of attacks on governmental entities, I feel that this aspect of the communication center should not be compromised on any level. It is understood that the proportional expenditures of monies will parallel the level of safety. If funding restrictions require the elimination, or reduction, of any design features, security must not be compromised.

Both Atkinson (1993) and Spahn (1999) discuss the importance of having a reliable air conditioning and ventilation system. The environment must be fresh, smoke free, frequently changed, and neither too hot, or too cool. In my opinion, this should be a basic requirement of all air-related systems. The need for redundant ventilation and air-conditioning ensures continued operation. Additionally, with the lack of independent controls, the center is susceptible to contaminated air being introduced from conditions such as a fire elsewhere in the building or even a terrorist attack. All building tenants share the existing ventilation and air-conditioning system. This increases the risk to the communication center through exposure from all the occurrences within the building. Without adequate ventilation and temperature controls the center may have to be evacuated, which seriously affects department-wide operations.

The Federal Emergency Management Agency (1996) reminds us of the great demands that detail works puts on one's eyes. Adequate illumination, which is glare free, must be provided. Recent renovations of the current center sufficiently addressed this lighting issue.

Atkinson (1993) says that the use of cable racks, trays, and conduits should be utilized to provide order and stability to the myriad of communication, electrical, and other utility components. This wire and ductwork must not be channeled over any portion of the dispatch

center essential to receiving or transmission of emergency communication. I agree with this premise. Existing utilities violates this basic concept. The constant humming of electrical components and wiring, or the flow of liquid present an unnecessary distraction to the personnel within the communication center. An even greater risk comes from the potential for failure of these components and the resulting damage to the sensitive equipment within. Again, the continuity of services can be compromised.

Burton (1997) has said that an incapacitated dispatcher is unable to contribute to the mitigation of an emergency situation. Should an emergency occur within the building, dispatchers must decide when to leave the center. Adequate information must be provided by a reliable automatic fire detection system. While the alarm system within the HMB meets the current code, the alarm panel is located in a separate room and is not under constant supervision. The National Emergency Management Agency (1999) recommends that the alarm system should be monitored in the dispatch operations room. This causes serious implications to the dispatch personnel. The panel's current location does not provide them with immediate notification of an alarm elsewhere in the building, potentially placing them in grave danger.

RECOMMENDATIONS

After gaining an accurate understanding of NFPA 1221, reviewing the appropriate literature available on the subject, a physical inspection of the existing facility and compiling sufficient data to answer the research questions; the following recommendations are offered.

In general, the Honolulu Fire Department should begin the process to replace its existing fire communication center. The quantity and severity of variance between what currently exist and the recommendations of the standards of NFPA 1221 warrants the abandonment of the existing facility. Since a recent renovation fell short of accomplishing parity with the NFPA

standard, the choices are narrowed to constructing a new stand-alone facility or incorporating a new dispatch center into the design and construction of the planned administration building. In either case, adherence to the recommendations of NFPA 1221 is of paramount importance.

Location

It is highly recommended that the new center be within reach of the City's fiber optic and microwave radio infrastructure to take advantage of this technology. It should also be within reasonable proximity to other City buildings to allow for quick response by other high-ranking city decision-makers. It should definitely be out of the flood zone and not in a basement. Another key factor would be its accessibility to the back-up fire communication center. The planned new administrative building either meets or has the potential to meet all of these requirements with appropriate changes to the design documents. Of course, a stand-alone facility could be built to the required specification.

Construction

The new center must be built to meet Atkinson's (1993) definition of an Essential Service Facility which would require the building to be constructed 1.5 times the commercial building requirement. Details such as the type of wall covering or paint, seismic considerations, and roof construction must be planned for.

Whether combining the dispatch center with the new administration building or a stand-alone facility is chosen, there must be adequate separation from adjacent occupancies. The use of fire rated vertical and horizontal barriers must also be utilized. Having a self-sufficient center including lunchroom and bath facilities would be minimally required.

Utilities

All necessary utilities should be redundant and separate from any adjacent occupancies. The ability to continue emergency operations under crisis situations is expected. Strategies to overcome power outages and interruption of telephone services should be designed into the system. Separate and monogamous ventilation and air conditioning will reduce the susceptibility to interference from external influences, all in an effort to provide continuity of service.

The actual layout of the routes these utilitarian components take must also be well thought out. No main utility service should pass through those portions of the dispatch center where essential equipment is installed.

Fire Protection

Early notification of a fire related problem would afford dispatch personnel a multitude of reactionary solutions. These choices exponentially diminish as the relationship between the growth of the fire and the delay in the notification time increases. Becoming aware of a small fire in its incipient stage can be dealt with in many ways; whereas, becoming aware of a full blown incident only as thick bellowing smoke and flames pour into your facility, leaves you with just one choice, to evacuate.

The new facility must have fire protection systems that are in accordance with NFPA 13 for its sprinkler system and NFPA 72 for its fire alarm, with the enunciator panel situated inside the dispatch room. Special consideration must be given to the protection of sensitive electronic and computer components.

Security

Doors and windows must be designed with the utmost attention to the security of the dispatch center and the personnel that work there. The guidance provided in NFPA 1221 must

be followed. Self-closing fire doors, bullet resistive windows that cannot be opened, and a secured vestibule will protect the communication center against terrorism, vandalism, and civil disturbances.

Consideration must be given to redundancy to the security measures. Should the primary line of defense be breached, secondary and even tertiary protection must be in place.

Summary

Now that it is clear that the existing communication center fails to meet some very crucial recommendations of NFPA 1221, measures to bring the center into compliance must be taken. A consensus standard that is developed by experts should be used to an agency's advantage.

Chief Officers face difficult problems in deciding how public resources are to be allocated and often receive insufficient information. I hope this research provided sufficient and subjective information in an effort to enhance the understanding of the issues underlying the existing communication center facility.

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